2009 Sunflower Insect Pest Problems and Insecticide Update

Janet J. Knodel[1], Laurence D. Charlet[2], Patrick B. Beauzay[1], Theresa A. Gross[2] and Anitha Chirumamilla[1]

[1]Department of Entomology, North Dakota State University, Dept. 7650, P.O. Box 6050, Fargo, ND 58108
[2]Northern Crop Science Laboratory, USDA, ARS, Box 5677, University Station, Fargo, ND 58105

Introduction

Sunflowers (*Helianthus annuus* L.) are native to North America and several insect pests attack and cause economic losses to sunflower production in the Great Plains. Head-infesting insects include the red sunflower seed weevil, *Smicronyx fulvus* LeConte (Coleoptera: Curculionidae), banded sunflower moth, *Cochylis hospes* Walsingham (Lepidoptera: Tortricidae), sunflower moth, *Homoeosoma electellum* (Hulst) (Lepidoptera: Pyralidae) and sunflower midge, *Contarinia schulzi* Gagné (Diptera: Cecidomyiidae) (Knodel et al. 2007). New emerging insect pests include the sunflower seed maggot, *Neotephritis finalis* (Loew) (Diptera: Tephritidae), and *Lygus* bug, *Lygus* species (Hemiptera: Miridae). Results of the 2009 National Sunflower Association (NSA) Regional Sunflower Insect Trapping Network and the 2009 Sunflower Survey are summarized for economically important sunflower insect pests. In addition, results from the 2009 foliar insecticide efficacy trial are reported.

Materials and Methods

2009 Regional Sunflower Insect Trapping Network

A Regional Sunflower Insect Trapping Network was coordinated by North Dakota State University (NDSU), United States Department of Agriculture (USDA) Agricultural Research Service (ARS) and National Sunflower Association (NSA) for banded sunflower moth and sunflower moth using winged pheromone traps. Traps were placed near sunflower fields and monitored weekly for moths from June through the end of August. The number of moths trapped was recorded. Pheromone lures were changed every three weeks and sticky trap bottoms were changed weekly. GPS coordinates were recorded for each site in decimal degrees format for mapping. The trapping network provides an early pest warning system for sunflower moth, which migrates annually into the northern sunflower production areas and can cause severe yield losses. For banded sunflower moth, it also provides information on seasonal flight activity and pest alerts for areas with high trap catches. As a result, field scouting can be timed and coordinated for high risk sunflower production areas.

National Sunflower Association Sunflower Survey

The National Sunflower Association organizes an annual sunflower field survey to assess yield, plant population, sunflower class (oil or confection), cultural practices, weed species and intensity, insect damage, bird damage, stalk lodging, and diseases affecting the sunflower industry. In September and October 2009, sunflower fields were surveyed in six states (North Dakota, South Dakota, Minnesota, Kansas, Colorado and Oklahoma) and one Canadian province

(Manitoba). Approximately one field was surveyed for every 10,000 acres in each state and county based on 2008 sunflower acreage as determined by the Farm Service Agency USDA and other state estimates.

Fields were selected at random in the major sunflower production counties. Date, field number and GPS coordinates were recorded for each field. All insect counts were conducted in the interior of the field about 25 m from the field edge. For banded sunflower moth, sunflower moth, red sunflower seed weevil and lygus bug, 100 seeds from five heads were collected for damage assessment. Seed damage for each of these insects was examined in the laboratory and percent damaged seed for each insect was determined. Only confection sunflower seeds were examined for brown spot caused by lygus bug. For sunflower midge and sunflower seed maggot, 10 heads were examined in the field. The Bracken rating scale (0 to 5) was used for sunflower midge, with 0 having no damage and 5 having damage so severe that the head does not open (Bracken 1991). The incidence of heads damaged from sunflower seed maggot was recorded.

2009 Sunflower Insecticide Trial

Insecticide efficacy applied as a foliar insecticide was evaluated for control of banded sunflower moth and red sunflower seed weevil in a field trial at the NDSU research farm near Prosper, ND, in 2009. The trial was conducted in a RCBD with four replications. Treatments included:

1) Untreated check
2) Asana XL @ 9.6 fl oz/a (standard)
3) Delta Gold @ 1.5 fl oz/a
4) Delta Gold @ 1.5 fl oz/a + InterLock @ 2 fl oz/a + AG 03015 @ 4 fl oz/a
5) Mustang Max @ 4 fl oz/a + COC @ 1% v/v
6) Mustang Max @ 3.2 fl oz/a + COC @ 1% v/v
7) Warrior II @ 1.28 fl oz/a
8) Declare II @ 1.54 fl oz/a
9) Coragen @ 5 fl oz/a

Sunflower was seeded on 30 May at a population of 20,000 plants/acre using a John Deere Flex-71 planter. Row spacing was 30 inches. On 27 May, 80 lbs N/acre (46-0-0 urea) was applied and incorporated. On 29 May, Treflan @ 2 pts/acre was applied and incorporated for early season grass control. Sunflower was cultivated on 26 June for weed control. Alleys were cut in the trial on 8 July using a tractor-mounted rototiller. This practice allowed for canopy closure and additional weed control, and lessened edge effects by maintaining a constant growth environment between plots for as long as possible. Plots were four rows wide by 30 feet long with 10-foot alleys on all sides of each plot to accommodate insecticide application. Insecticide applications were made on 10 Aug at plant growth stage R5.1 using a tractor-mounted CO_2 sprayer and offset boom with T-Jet 80015 nozzles at 40 psi and an application volume of 20 GPA. Ten heads from the center two rows of each plot were hand-harvested on 5-6 Nov for banded sunflower moth and red sunflower seed weevil seed damage assessment. Heads were dried to 10% moisture. Each head was threshed, and the diameter and total seed weight were recorded. A subsample of 200 randomly-selected seeds from each head was evaluated for banded sunflower moth and red sunflower seed weevil seed damage. Damage caused by each of these insects was recorded. Plots were machine-harvested on 2 December using a Kincaid 8XP plot combine with weigh bucket and moisture sensor. Plot weights from the hand-harvested heads

were added to the plot weights from machine-harvesting to obtain total plot yields. All yields were adjusted to 10% moisture and are reported in lbs/acre.

All insect seed damage and yield data were subjected to ANOVA and treatment means were tested for significance using Fisher's Protected LSD at $P \leq 0.05$ using PROC GLM in SAS statistical software.

Results and Discussion

2009 Regional Sunflower Insect Trapping Network

Results of the 2009 Regional Sunflower Insect Trapping Network were mapped weekly and posted on the NSA website during the field season, and then archived at the NDSU Extension Entomology IPM website.
http://www.ag.ndsu.nodak.edu/aginfo/entomology/entupdates/sunflower_network.htm
A total of 39 cooperators from eight states (Colorado, Kansas, Oklahoma, North Dakota, Minnesota, Nebraska, South Dakota, and Texas) and one Canadian province (Manitoba) participated in the network. Two examples of the trapping network for banded sunflower moth and sunflower moth are shown in Figures 1 and 2, respectively.

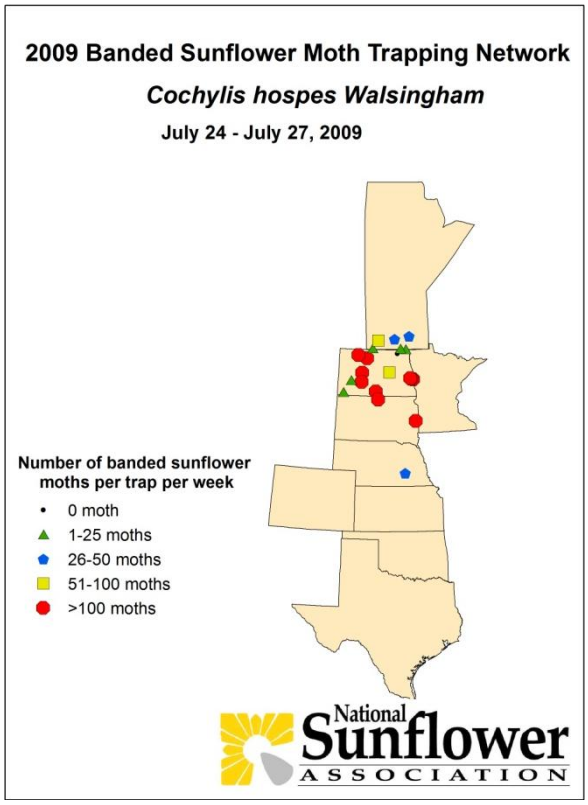

Figure 1. Banded sunflower moth.

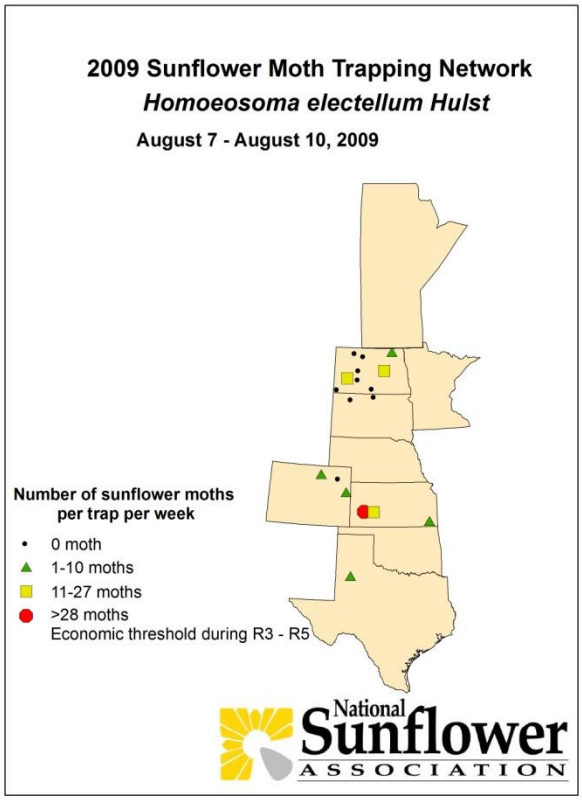

Figure 2. Sunflower moth.

2009 National Sunflower Association Sunflower Survey

One-hundred and seventy seven fields were surveyed by 23 teams in 2009. The 2009 maps are placed on the following website for each state surveyed:

http://www.ag.ndsu.nodak.edu/aginfo/ndipm/index.htm

Sunflower Midge: Females lay eggs on developing buds, either in the center of the bud or beneath the bracts. Larvae feed on tissue beneath the bracts and in the developing receptacle. Damage from light infestations is evident by bract scarring only, and little or no economic loss may occur. With more severe infestations, head cupping and central dead areas occur. This results in loss of seed development. Damage is typically restricted to field margins in lightly infested fields, although field-wide damage and significant yield loss can occur in heavily infested fields. In recent years, midge activity has been limited to a few "hot-spots" within the state. In 2009, midge damage was only reported in Colorado, North Dakota, Manitoba, South Dakota and Oklahoma. The majority of damage was rated low (Bracken 1 or 2). Examples of sunflower midge maps for North Dakota and South Dakota are shown in Figures 3 and 4, respectively.

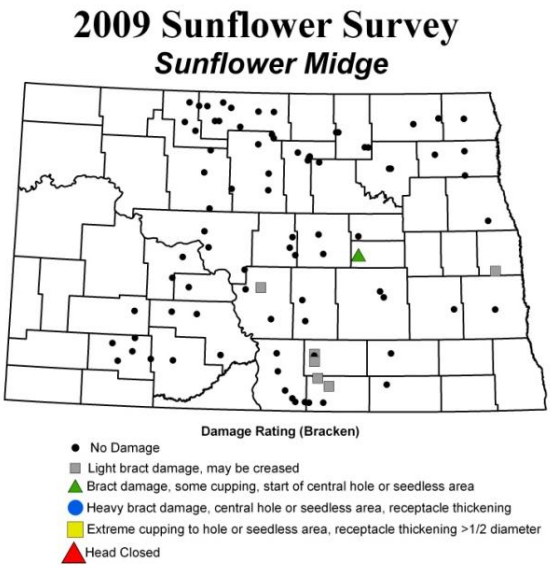

Figure 3. North Dakota.

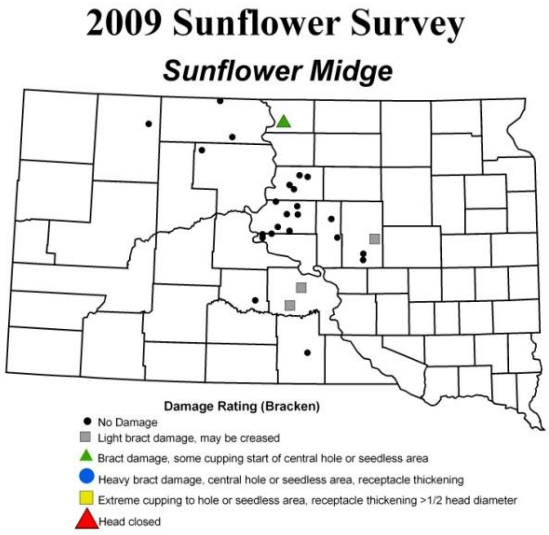

Figure 4. South Dakota.

Sunflower seed maggot: The sunflower seed maggot can be a serious pest of sunflower and is distributed throughout North America. Recent field observations have revealed that sunflower seed maggot can cause substantial damage to sunflower heads (annual NSA sunflower surveys and seed company representatives). Damage caused by sunflower seed maggot is seed sterility and deformed heads from larval tunneling. In 2009, sunflower seed maggot was only observed in two states (North Dakota and South Dakota) and one province Manitoba. Overall, populations were low and decreased from the 2008 sunflower survey. Percent heads with damage for North Dakota and South Dakota are shown in Figures 5 and 6, respectively.

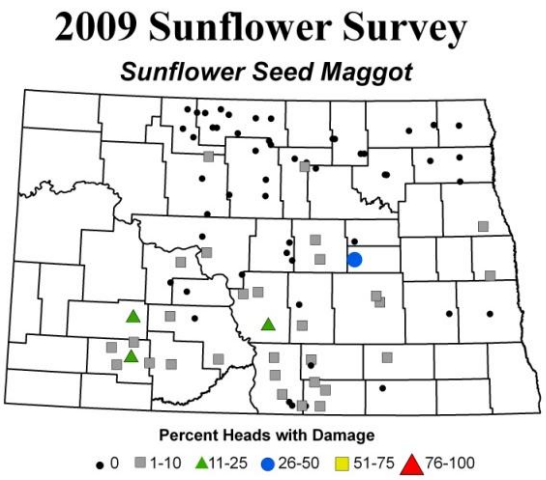

Figure 5. North Dakota.

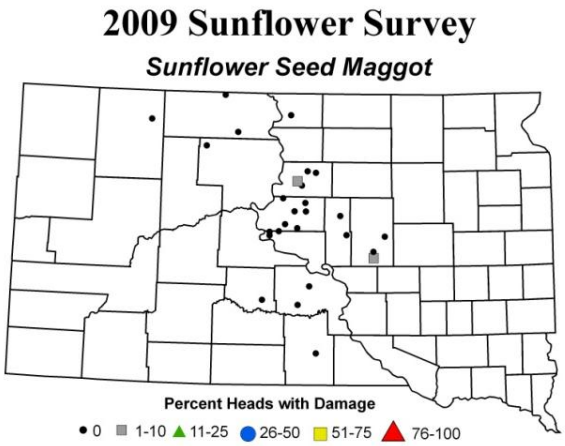

Figure 6. South Dakota.

Head-feeding Insects:

Banded sunflower moth: Banded sunflower moth is the most widespread and damaging sunflower insect pest in the northern Great Plains. Incidence of seed damaged by banded sunflower moth was highest in Manitoba at 45%, North Dakota 35%, South Dakota 25% and Minnesota 22% (Fig. 7). Damaged seed caused by banded sunflower moth was not found in seed samples from other states. Percent seed damaged by banded sunflower moth were just over 1% in both North Dakota and Manitoba (Fig. 8). Percent seed damaged by banded sunflower moth for North Dakota and Manitoba are shown in Figures 9 and 10, respectively.

Sunflower moth: Incidence of seed damaged by sunflower moth was only at 10% from Kansas and 2% from North Dakota (Fig. 7). Other state seed samples did not show any sunflower moth damage or presence. Damage by sunflower moth was limited in most areas. Kansas samples showed only slight seed damage from the sunflower moth (Fig. 8).

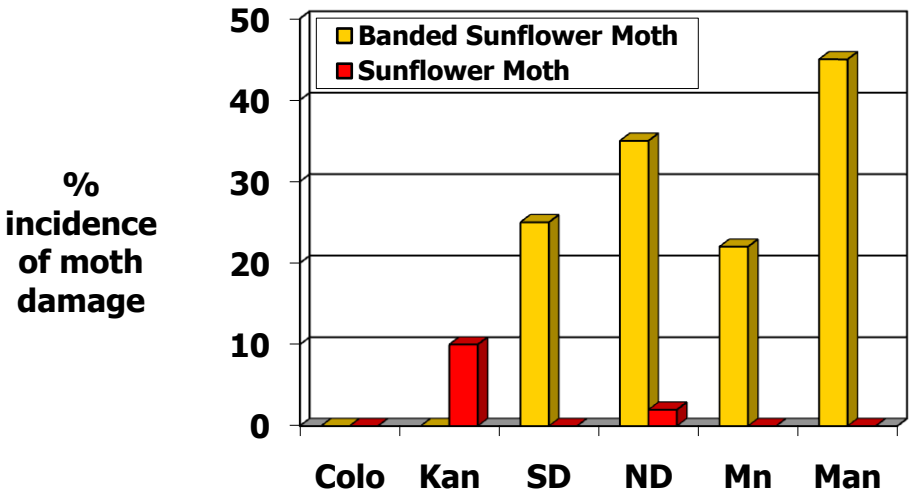

Figure 7. Incidence of seed damaged by banded sunflower moth and sunflower moth in 2009 Sunflower Survey

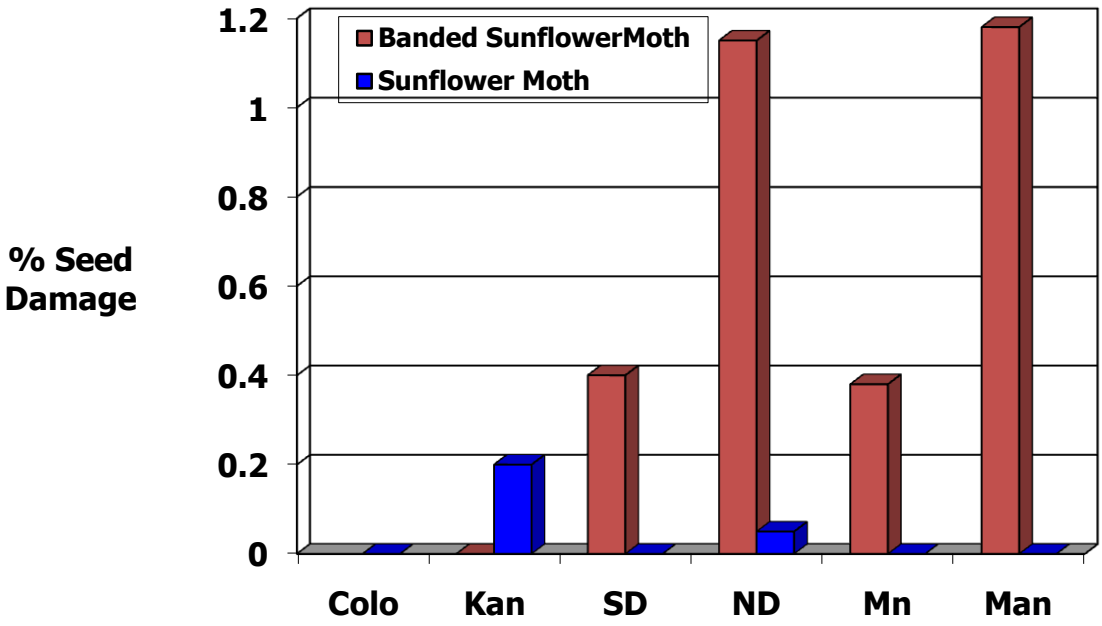

Figure 8. Percent seed damaged by banded sunflower moth and sunflower moth in 2009 Sunflower Survey.

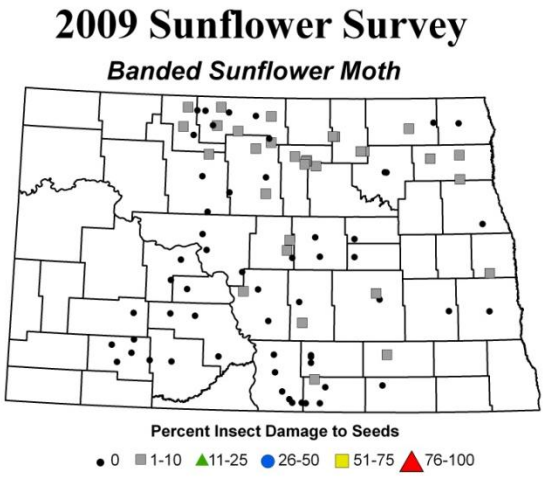

Figure 9. North Dakota.

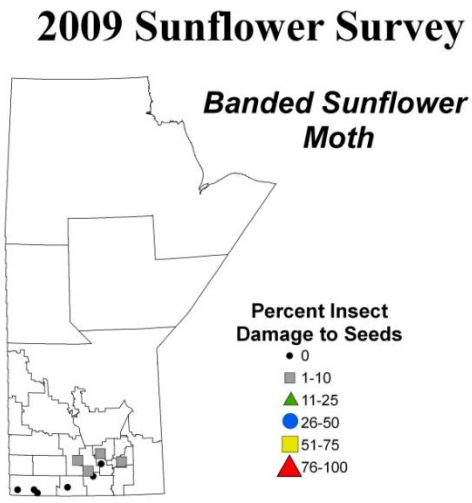

Figure 10. Manitoba.

Head-feeding Insects (continued):

Red Sunflower Seed Weevil: Incidence of seed damaged by red sunflower seed weevil in fields sampled was highest in North Dakota (53%), South Dakota (43%), Colorado (40%) and Kansas (30%) (Fig. 11). Seed damaged by red sunflower seed weevil was highest in North Dakota (2.5%), South Dakota (1.8%) and Kansas (1.4%) (Fig. 12). Seed damage was low in Colorado (<1%), Minnesota (<0.5%) and Manitoba (<0.5%). Percent seed damaged by red sunflower seed weevil for North Dakota and South Dakota are shown in Figures 13 and 14, respectively.

Lygus Bug: Lygus bug causes a seed injury called brown spot on confection sunflowers. It was found to be severe in Manitoba and to a limited extent in North Dakota. Brown spot was detected in 54% of the confection samples sent from Manitoba (Fig. 11). A large portion of the Manitoba's sunflower production is confection. Brown spot incidence in North Dakota's confection samples was 27% (Fig. 12). The percent seed damaged by lygus bug for North Dakota and Manitoba is shown in Figures 15 and 16, respectively.

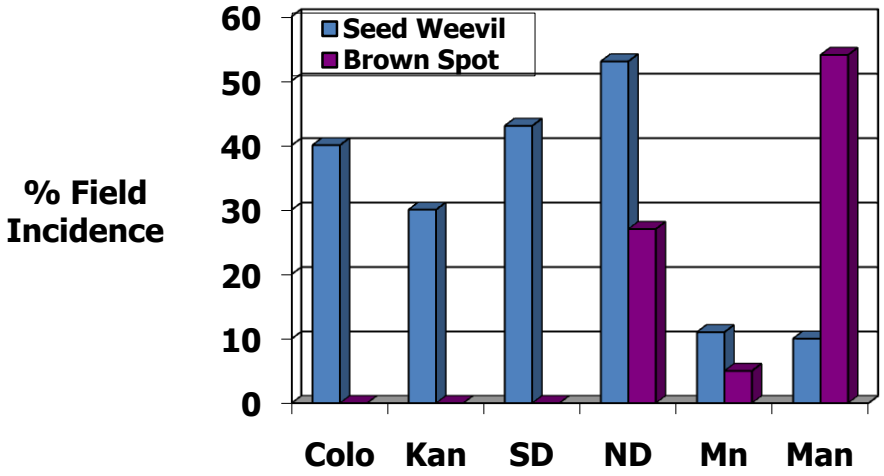

Figure 11. Incidence of seed damaged from red sunflower seed weevil and Lygus bug (brown spot) in 2009 Sunflower Survey.

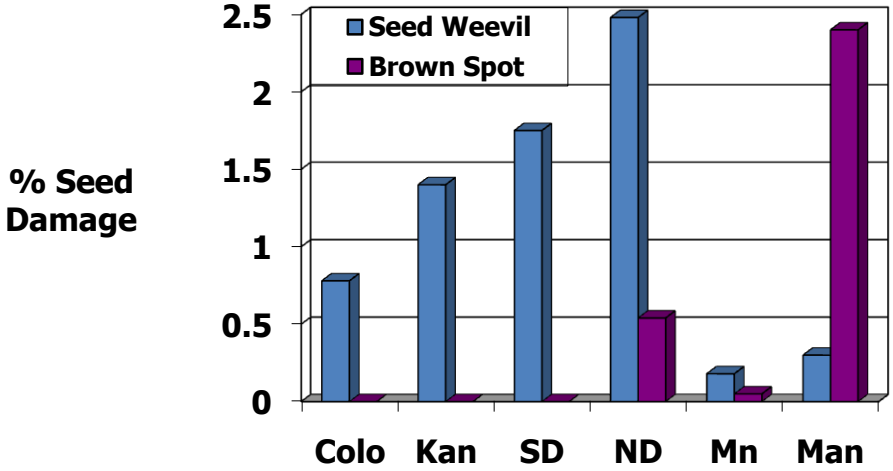

Figure 12. Percent seed damaged from red sunflower seed weevil and lygus bug (brown spot) in 2009 Sunflower Survey.

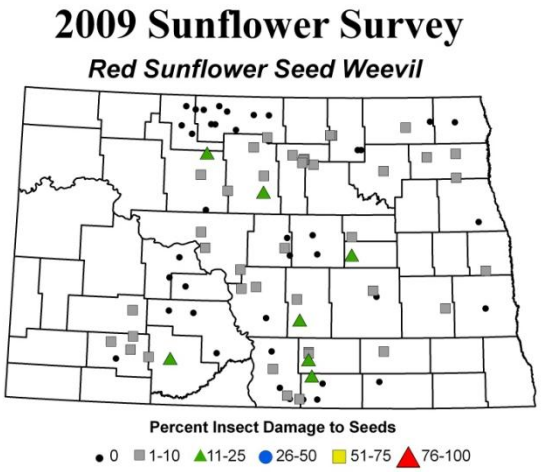

Figure 13. North Dakota.

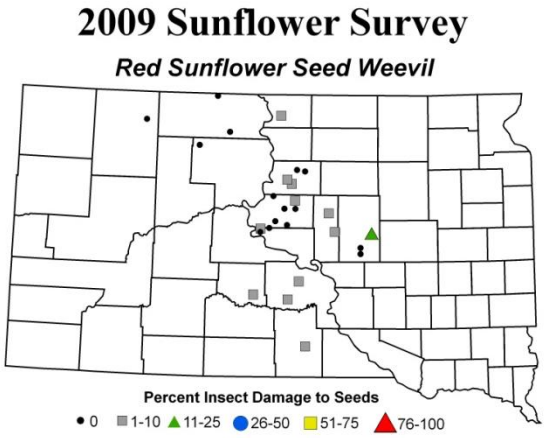

Figure 14. South Dakota.

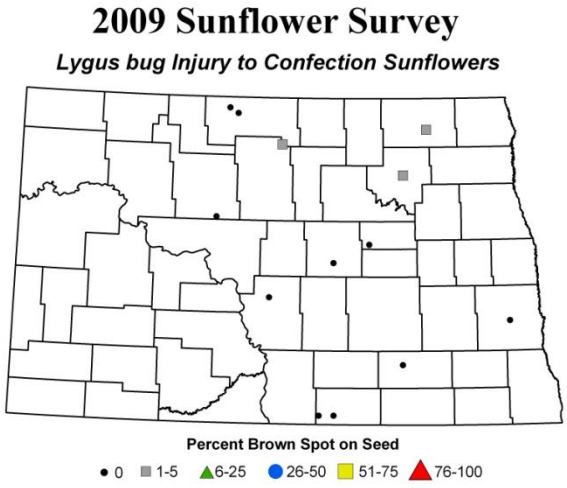

Figure 15. North Dakota.

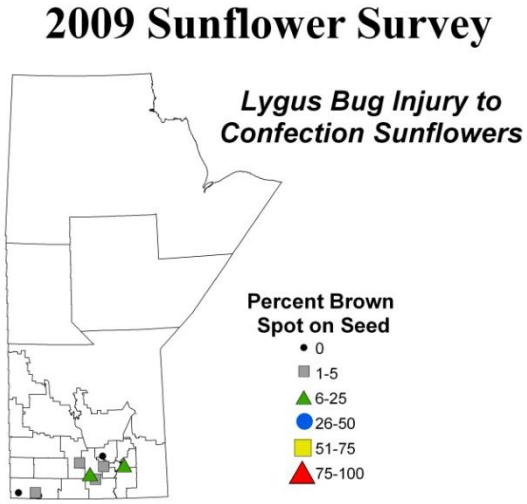

Figure 16. Manitoba.

2009 Sunflower Insecticide Trail

Banded sunflower moth and red sunflower seed weevil damage was very light in 2009. The later than normal planting date is known to mitigate banded sunflower moth damage and populations of the red sunflower seed weevil have been low for a number of years. All insecticide treatments had significantly less banded sunflower moth damage (Fig. 17) than the untreated check, except for Delta Gold + InterLock + AG 03015. All insecticide treatments had significantly less red sunflower seed weevil damage than the untreated check, except for Delta Gold + InterLock + AG 03015, Delta Gold and Coragen. This may not be an accurate reflection of insecticide efficacy, as populations of seed weevils were low. There were no significant differences in yield among all treatments (Fig. 17).

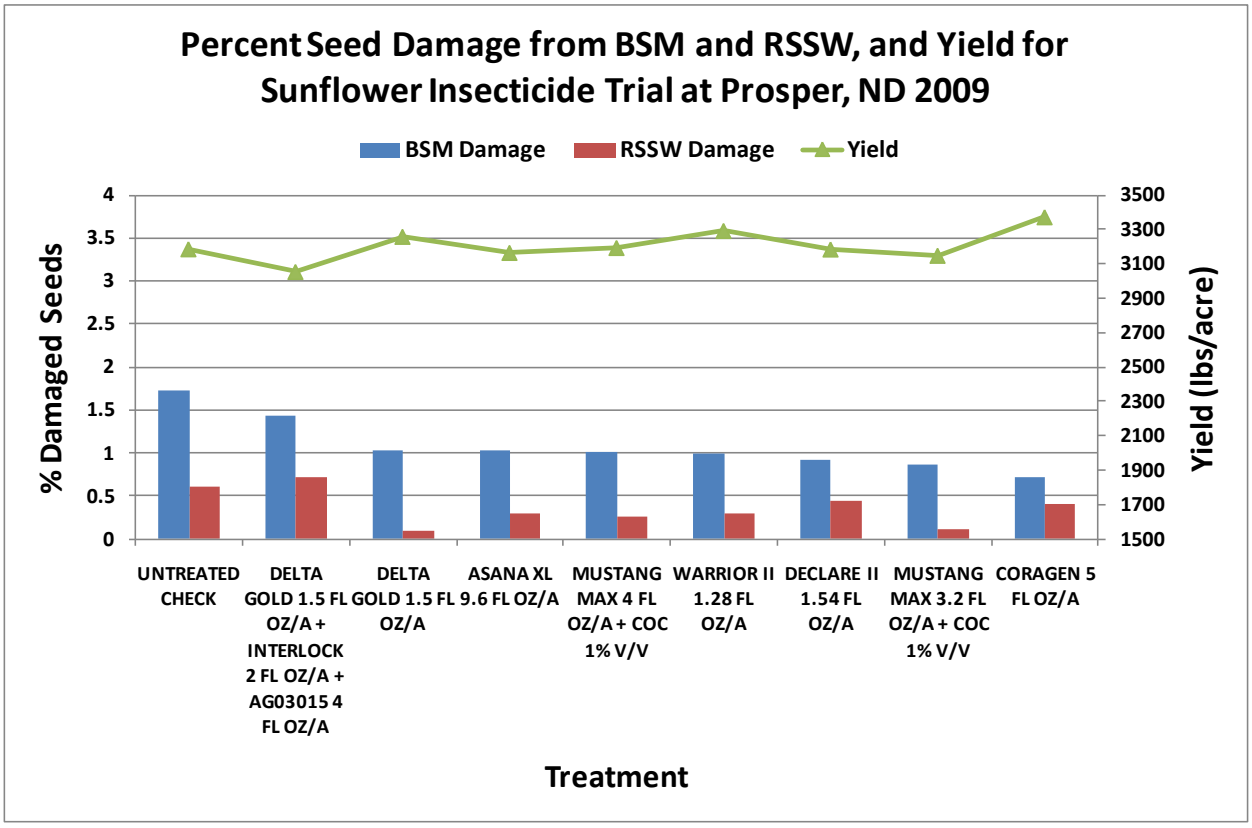

Figure 17. Percent seed damage from banded sunflower moth (BSM) and red sunflower seed weevil (RSSW) and yield for sunflower insecticide trial at Prosper, ND 2009.

Literature Cited

Bracken, G.K. 1991. A damage index for estimating yield loss in sunflowers caused by sunflower midge. Can. J. Plant Sci. 71: 81-85.

Knodel, J.J., and L.D. Charlet. 2007. IV. Pest Management – Insects. In *Sunflower Production*, D.R. Berglund (editor), NDSU Ext. Serv. A-1331 (EB-25 Revised).

North Dakota Agricultural Statistics. 2009. No. 78, June 2009.

Acknowledgments

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